

tion for the current month was the greatest on record at: Portland, Me., 9.57; Indianapolis, 8.17; Block Island, 7.76; Rapid City, 2.58; Pueblo, 1.41. It was not the least on record at any regular station of the Weather Bureau.

## HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 11. California, 6, 22. Colorado, 2, 3, 7, 9, 17, 21, 22, 24. Connecticut, 19. Georgia, 4. Idaho, 22, 23. Illinois, 2, 5, 14, 16, 18, 19, 26, 28. Kansas, 4, 8, 24. Kentucky, 17, 18, 24. Maryland, 20. Massachusetts, 9, 19. Michigan, 12. Mississippi, 12. Missouri, 4, 5, 16, 17, 18, 20, 27. Montana, 22. New Jersey, 3, 17, 19. New Mexico, 17, 23. New York, 17, 19. North Carolina, 11, 12, 19. North Dakota, 1, 12, 14, 15, 18. Ohio, 5. Pennsylvania, 17. Rhode Island, 17. South Dakota, 16. Tennessee, 19. Utah, 1, 8, 9, 11, 22 to 25. Virginia, 3, 18. Washington, 12, 15. West Virginia, 19. Wyoming, 25.

## SLEET.

The following are the dates on which sleet fell in the respective States:

California, 22. Colorado, 9, 18, 26. Michigan, 18, 19, 21. Minnesota, 18. Missouri, 28. Montana, 8, 15, 25, 26. New Hampshire, 24.

## WIND.

The prevailing winds for September, 1896, viz, those that were recorded most frequently, are shown in Table I for the regular Weather Bureau stations.

The resultant winds, as deduced from the personal observations made at 8 a. m. and 8 p. m., are given in Table IX. These latter resultants are also shown graphically on Chart IV, where the small figure attached to each arrow shows the number of hours that this resultant prevailed, on the assumption that each of the morning and evening observations represents one hour's duration of a uniform wind of average velocity. These figures indicate the relative extent to which winds from different directions counterbalanced each other.

## HIGH WINDS.

Maximum wind velocities of 50 miles or more per hour were reported during this month at regular stations of the Weather Bureau as follows (maximum velocities are averages for five minutes; extreme velocities are gusts of shorter duration, and are not given in this table):

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
		Miles				Miles	
Block Island, R. I. ....	9	75	ne.	Hatteras, N. C. ....	23	51	n.
Do. ....	10	60	ne.	Jacksonville, Fla. ....	29	70	se.
Do. ....	13	51	ne.	Kittyhawk, N. C. ....	23	58	ne.
Buffalo, N. Y. ....	6	50	sw.	Do. ....	30	55	sw.
Do. ....	19	57	w.	Lexington, Ky. ....	30	56	sw.
Do. ....	30	52	sw.	Nantucket, Mass. ....	9	50	e.
Charleston, S. C. ....	29	62	s.	Do. ....	10	55	s.
Cleveland, Ohio. ....	19	54	w.	New York, N. Y. ....	30	56	se.
Fort Canby, Wash. ....	30	52	s.	Savannah, Ga. ....	29	70	se.
Harrisburg, Pa. ....	30	72	s.	Washington, D. C. ....	29	66	se.

## SUNSHINE AND CLOUDINESS.

The quantity of sunshine, and therefore of heat, received by the atmosphere as a whole is very nearly constant from year to year, but the proportion received by the surface of the earth depends upon the absorption by the atmosphere, and varies largely with the distribution of cloudiness. The sunshine is now recorded automatically at 19 regular stations of the Weather Bureau by its photographic, and at

24 by its thermal effects. At one station records are kept by both methods. The photographic record sheets show the apparent solar time, but the thermometric records show seventy-fifth meridian time; for convenience the results are all given in Table XI for each hour of local mean time.

Photographic and thermometric registers give the duration of that intensity of sunshine which suffices to make a record, and, therefore, they generally fail to record for a short time after sunrise and before sunset, because, even in a cloudless sky, the solar rays are then too feeble to affect the self-registers. If, therefore, such records are to be used for determining the amount of cloudiness, they must be supplemented by special observations of the sky near the sun at these times. The duration of clear sky thus specially determined constitutes the so-called twilight correction (more properly a low-sun correction), and when this has been applied, as has been done in preparing Table XI, there results a complete record of the clearness of the sky from sunrise to sunset in the neighborhood of the sun. The twilight correction is not needed when the self-registers are used for ascertaining the duration of a special intensity of sunshine, but is necessary when the duration of cloudiness is alone desired, as is usually the case.

The average cloudiness of the whole sky is determined by numerous personal observations at all stations during the daytime, and is given in the column "average cloudiness" in Table I; its complement, or percentage of clear sky, is given in the last column of Table XI.

## Difference between instrumental and personal observations of sunshine.

Stations.	Apparatus.	Total possible duration for the whole month.	Personal estimated area of clear sky.				Instrumental record of sunshine.			
			Photographic.	Difference.	Thermometric.	Difference.	Photographic.	Difference.	Thermometric.	Difference.
Bismarek, N. Dak. ....	P.	376.9	56	57	+ 1	...	...	...	...	...
Helena, Mont. ....	P.	376.9	54	60	+ 6	...	...	...	...	...
Portland, Oreg.* ....	P.	376.1	65	63	- 2	...	...	...	...	...
Eastport, Me. ....	T.	376.1	65	...	...	63	- 2	...	...	...
Minneapolis, Minn. ....	P.	375.8	31	42	+ 9	...	...	...	...	...
Northfield, Vt. ....	T.	375.8	...	...	...	53	...	...	...	...
Portland, Me. ....	P.	375.4	37	43	+ 6	...	...	...	...	...
Buffalo, N. Y. ....	T.	375.0	42	...	...	50	+ 15	...	...	...
Rochester, N. Y. ....	T.	375.0	42	...	...	56	+ 14	...	...	...
Boston, Mass. ....	T.	374.5	42	...	...	49	+ 7	...	...	...
Chicago, Ill. ....	T.	374.5	42	...	...	51	+ 9	...	...	...
Cleveland, Ohio. ....	T.	374.5	45	...	...	56	+ 11	...	...	...
Des Moines, Iowa. ....	P.	374.5	39	...	...	...	...	...	...	...
Dubuque, Iowa. ....	T.	374.5	38	...	...	51	+ 3	...	...	...
Detroit, Mich. ....	T.	374.5	39	...	...	...	...	...	...	...
Cheyenne, Wyo. ....	T.	374.5	48	...	...	58	+ 10	...	...	...
Eureka, Cal. ....	P.	374.0	45	61	+ 16	...	...	...	...	...
New York, N. Y. ....	P.	374.0	44	48	+ 4	...	...	...	...	...
Omaha, Nebr. ....	T.	374.0	48	...	...	49	+ 1	...	...	...
Salt Lake City, Utah. ....	P.	374.0	52	61	+ 9	...	...	...	...	...
Columbus, Ohio. ....	P.	374.0	52	81	+ 29	...	...	...	...	...
Denver, Colo. ....	T.	373.6	39	...	...	39	+ 7	...	...	...
Philadelphia, Pa. ....	P.	373.6	55	63	+ 8	...	...	...	...	...
Baltimore, Md. ....	T.	373.6	47	...	...	64	+ 17	...	...	...
Cincinnati, Ohio. ....	T.	373.4	50	...	...	54	+ 4	...	...	...
Kansas City, Mo. ....	T.	373.4	49	...	...	68	+ 19	...	...	...
St. Louis, Mo. ....	P.	373.4	47	52	+ 5	...	...	...	...	...
Washington, D. C. ....	T.	373.4	46	...	...	60	+ 14	...	...	...
Dodge City, Kans. ....	P.	373.4	50	60	+ 1	...	...	...	...	...
Louisville, Ky. ....	P.	373.0	58	66	+ 8	...	...	...	...	...
San Francisco, Cal. ....	T.	373.0	48	...	...	58	+ 10	...	...	...
Fresno, Cal. ....	T.	372.6	58	...	...	61	+ 5	...	...	...
Santa Fe, N. Mex. ....	P.	372.2	82	...	...	88	+ 6	...	...	...
Little Rock, Ark. ....	T.	372.2	60	68	+ 8	...	...	...	...	...
Atlanta, Ga. ....	T.	372.0	61	...	...	73	+ 12	...	...	...
Wilmington, N. C. ....	T.	371.8	65	...	...	62	- 3	...	...	...
Phoenix, Ariz. ....	T.	371.8	70	...	...	81	+ 11	...	...	...
San Diego, Cal. ....	P.	371.4	72	...	...	...	...	...	...	...
Savannah, Ga. ....	P.	371.4	73	75	- 4	...	...	...	...	...
Vicksburg, Miss. ....	T.	371.4	72	71	- 1	...	...	...	...	...
New Orleans, La. ....	T.	371.4	77	...	...	79	+ 2	...	...	...
Galveston, Tex. ....	T.	370.4	61	...	...	61	0	...	...	...
	P.	370.4	63	71	+ 8	...	...	...	...	...

\*Record by both methods.

+The personal estimates are for 30 days but the instrumental records are for 28 days only, for which the total possible was 347.8 hours.

## COMPARISON OF DURATIONS AND AREAS.

The sunshine registers give the *durations* of effective sunshine whence the duration relative to possible sunshine is derived; the observer's personal estimates give the percentage of *area* of clear sky. These numbers have no necessary relation to each other, since stationary banks of clouds may obscure the sun without covering the sky, but when all clouds have a steady motion past the sun and are uniformly scattered over the sky, the percentages of duration and of area agree closely. For the sake of comparison, these percentages have been brought together, side by side, in the following table, from which it appears that, in general, the instrumental records of percentages of durations of sunshine are almost always larger than the observers' personal estimates of percentages of area of clear sky; the average excess for September, 1896, is 7 per cent for photographic and 8 per cent for thermometric records.

The details are shown in the following table, in which the stations are arranged according to the greatest possible duration of sunshine, and not according to the *observed* duration as heretofore.

## ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table X, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

*Thunderstorms.*—The dates on which reports of thunderstorms for the whole country were most numerous were: 3d, 208; 5th, 136; 12th, 147; 17th, 138; 18th, 150; 19th, 247.

Thunderstorm reports were most numerous in: Florida, 111; Illinois, 157; Massachusetts, 102; Missouri, 238; North Carolina, 127; Ohio, 109; Pennsylvania, 105.

Thunderstorm were most frequent in: Florida, 26 days; Illinois, 20; Missouri, 25; North Carolina and Texas, 21.

*Auroras.*—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, from the 17th to the 25th, inclusive. On the remaining twenty-one days of this month 35 reports were received, or an average of about 1.5 per day. The date on which the number of reports especially exceeded this average were: 4th, 7; 18th, 9; 30th, 10.

Auroras were reported by a large percentage of observers, in Minnesota and New Hampshire, 22; North Dakota, 26 per cent.

Auroras were reported most frequently in: Minnesota, 11 days; North Dakota, 6.

## CANADIAN REPORTS.

*Thunderstorms* were reported as follows: Yarmouth, 17th, 19th, 20th; Montreal, 17th; Toronto, 27th; Port Stanley, 5th; Saugeen, 6th; Port Arthur, 9th.

*Auroras* were reported as follows: Father Point, 12th, 15th; Quebec, 3d, 4th, 15th; Toronto, 19th; Port Arthur, 13th, 16th; Winnipeg, 3d, 13th, 15th, 22d, 30th; Minnedosa, 1st, 2d, 6th; Medicine Hat, 30th; Prince Albert, 2d; Edmonton, 3d, 6th.

## INLAND NAVIGATION.

The *extreme and average stages of water* in the rivers for the current month are given in Table VIII, from which it appears that the only case in which a river exceeded danger line was that of the James River, at Lynchburg, Va., which had risen 0.2 feet above danger line on the 30th, in consequence of the heavy rains that had fallen the day before in connection with the hurricane in that region. These rains were heaviest in the mountainous parts of western Virginia, Maryland, and central Pennsylvania. In general, the rivers maintained a very uniform stage of water; the greatest ranges during the month were: 9.4 at Chattanooga, and 8.4 at Kansas City and Cairo.

## CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following extracts relating to the general weather conditions in the several States and Territories are taken from the monthly reports of the respective services.

Snowfall and rainfall are expressed in inches.

*Alabama.*—The mean temperature was 75.8°, or 0.7° above normal; the highest was 104°, at Ashville on the 18th, and the lowest, 35°, at Healing Springs and Pineapple on the 30th. The average precipitation was 1.76, or 0.98 below normal; the greatest monthly amount, 3.95, occurred at Rock Mills; no rain fell at Pineapple. The drought which began during the second decade of July, over the central and northern portions of the State, and which was practically unbroken during August, continued with very little exception until the last decade of September, when it was partially broken by scattered, and in some places heavy, showers; but in some portions, notably in Wilcox and adjoining counties, the drought continued throughout the month. The effect of the weather on growing crops was a continuation of that reported for August; all late summer crops were either prematurely forced or entirely checked; in both cases there resulted inferior yields. Cotton was nearly all gathered in by the end of the month, closing a phenomenally early cotton season in this State.

*Arizona.*—Report not received.

*Arkansas.*—The mean temperature was 73.3°, or 0.4° above normal; the highest was 106°, at Hot Springs and Prescott on the 17th, and the lowest, 35°, at Corning on the 22d, La Crosse, Keesees Ferry, and Brinkley on the 29th, and Witts Springs on the 27th and 28th. The average precipitation was 3.25, or 0.19 above normal; the greatest monthly amount, 5.07, occurred at Moore, and the least, 0.69, at Gaines Landing.

*California.*—The mean temperature was 67.9°, or 1.9° below normal; the highest was 118°, at Volcano Springs on the 15th, and the lowest, 18°, at Bodie on the 19th. The average precipitation was 0.37, or 0.16

above normal; the greatest monthly amount, 2.29, occurred at Laporte, while no rain fell at numerous stations.

*Colorado.*—The mean temperature was 57.4°, or about 1.0° below normal; the highest was 104°, at Lamar on the 1st, and the lowest, 9.0° at Breckenridge on the 28th. The average precipitation was 2.04, or 1.13 above normal; the greatest monthly amount, 5.14, occurred at T. S. Ranch, and the least, 0.15, at Lajara.

*Florida.*—The mean temperature was 79.5°, or 4.2° above normal; the highest was 100°, at McClenny on the 13th, and the lowest, 48°, at Milton on the 30th. The average precipitation was 4.42, or 0.55 below normal; the greatest monthly amount, 11.12, occurred at Myers, and the least, 0.70, at McClenny. The climatic features of the month were generally abnormal, as indicated by excessive heat and deficiency in precipitation. The drought which began to be seriously felt as early as July still influences the conditions over the greater portion of the State, and its ill effects are evident in the rapidly maturing crops. Cotton opened before maturing, hastened by dry weather and constant sunshine. Though staple crops, such as corn, cotton, and potatoes have been injured, and a reduced production conceded, September has been an ideal month for harvesting. No generally excessive rains prevailed, and all cotton housed was in an excellent condition. A decided departure from these satisfactory conditions took place on the 29th, when a West India hurricane passed over portions of the State. Approaching the coast near Cedar Keys on the morning of the 29th, it pursued a north-northeasterly course through Levy, Lafayette, Alachua, Bradford, Suwannee, Columbia, Baker, and Nassau counties, leaving death and destruction in its wake. The center of the storm passed through portions of the above counties. The effect of the hurricane was felt over the entire northeast portions of the State. At least 50 lives were lost, and damage to the amount of \$3,000,000 was the result. Continued dry weather has retarded the growth of plants, and has largely operated to delay sowing over the greater portion of the State. Citrus